P^TENT COOPERATION TREA^Y

From the INTERNATIONAL BUREAU

PCT

NOTIFICATION OF ELECTION

(PCT Rule 61.2)

To:

Assistant Commissioner for Patents
United States Patent and Trademark Office
Box PCT
Washington, D.C.20231
ETATS-UNIS D'AMERIQUE

in its capacity as elected Office

Date of mailing (day/month/year) 15 June 2000 (15.06.00)	
International application No. PCT/FI99/00868	**Applicant's or agent's file reference** 2980530PC/TA
International filing date (day/month/year) 19 October 1999 (19.10.99)	**Priority date** (day/month/year) 21 October 1998 (21.10.98)
Applicant VERKAMA, Markku	

1. The designated Office is hereby notified of its election made:

[X] in the demand filed with the International Preliminary Examining Authority on:

19 May 2000 (19.05.00)

[ ] in a notice effecting later election filed with the International Bureau on:

2. The election [X] was

[ ] was not

made before the expiration of 19 months from the priority date or, where Rule 32 applies, within the time limit under Rule 32.2(b).

The International Bureau of WIPO **34, chemin des Colombettes** **1211 Geneva 20, Switzerland**	Authorized officer Claudio Borton
Facsimile No.: (41-22) 740.14.35	Telephone No.: (41-22) 338.83.38

PATENT COOPERATION TREATY

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INTERNATIONAL PRELIMINARY EXAMINATION REPORT

(PCT Article 36 and Rule 70)

Applicant's or agent's file reference	FOR FURTHER ACTION	See Notification of Transmittal of International Preliminary Examination Report (Form PCT/IPEA/416)
2980530PC/TA		
International application No.	International filing date *(day/month/year)*	Priority date *(day/month/year)*
PCT/FI99/00868	19.10.1999	21.10.1998
International Patent Classification (IPC) or national classification and IPC7		
H 04 Q 7/22, H 04 M 7/00		
Applicant		
Nokia Networks OY et al		

1. This international preliminary examination report has been prepared by this International Preliminary Examining Authority and is transmitted to the applicant according to Article 36.

2. This REPORT consists of a total of 6 sheets, including this cover sheet.

   ☒ This report is also accompanied by ANNEXES, i.e., sheets of the description, claims and/or drawings which have been amended and are the basis for this report and/or sheets containing rectifications made before this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions under the PCT).

   These annexes consist of a total of 3 sheets.

3. This report contains indications relating to the following items:

   - I ☒ Basis of the report
   - II ☒ Priority
   - III ☐ Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
   - IV ☐ Lack of unity of invention
   - V ☒ Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
   - VI ☒ Certain documents cited
   - VII ☐ Certain defects in the international application
   - VIII ☐ Certain observations on the international application

Date of submission of the demand	Date of completion of this report
19.05.2000	15.02.2001
Name and mailing address of the IPEA/SE	Authorized officer
Patent- och registreringsverket Box 5055 S-102 42 STOCKHOLM Facsimile No. 08-667 72 88	Telex 17978 PATOREG-S Gunnel Wästerlid/MN Telephone No. 08-782 25 00

Form PCT/IPEA/409 (cover sheet) (January 1998)

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International application No.
PCT/FI99/00868

I. Basis of the report

1. With regard to the **elements** of the international application:*

☐ the international application as originally filed

☒ the description:
pages 1-13 , as originally filed
pages _____ , filed with the demand
pages _____ , filed with the letter of _____

☒ the claims:
pages _____ , as originally filed
pages _____ , as amended (together with any statement) under article 19
pages _____ , filed with the demand
pages 14-16 , filed with the letter of 05.12.2000

☒ the drawings:
pages 1/2 - 2/2 , as originally filed
pages _____ , filed with the demand
pages _____ , filed with the letter of _____

☐ the sequence listing part of the description:
pages _____ , as originally filed
pages _____ , filed with the demand
pages _____ , filed with the letter of _____

2. With regard to the **language**, all the elements marked above were available or furnished to this Authority in the language in which the international application was filed, unless otherwise indicated under this item.
These elements were available or furnished to this Authority in the following language _____ which is:

☐ the language of a translation furnished for the purposes of international search (under Rule 23.1(b)).

☐ the language of publication of the international application (under Rule 48.3(b)).

☐ the language of the translation furnished for the purposes of international preliminary examination (under Rules 55.2 and/or 55.3).

3. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, the international preliminary examination was carried out on the basis of the sequence listing:

☐ contained in the international application in written form.

☐ filed together with the international application in computer readable form.

☐ furnished subsequently to this Authority in written form.

☐ furnished subsequently to this Authority in computer readable form.

☐ The statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.

☐ The statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished.

4. ☐ The amendments have resulted in the cancellation of:

☐ the description, pages _____

☐ the claims, Nos. _____

☐ the drawings, sheet/fig _____

5. ☐ This report has been established as if (some of) the amendments had not been made, since they have been considered to go beyond the disclosure as filed, as indicated in the Supplemental Box (Rule 70.2 (c)).**

* *Replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are annexed to this report since they do not contain amendments (Rules 70.16 and 70.17).*

** *Any replacement sheet containing such amendments must be referred to under item I and annexed to this report.*

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International application No.
PCT/FI99/00868

II. Priority

1. ☐ This report has been established as if no priority had been claimed due to the failure to furnish within the prescribed time limit the requested:

   ☐ copy of the earlier application whose priority has been claimed (Rule 66.7(a)).

   ☐ translation of the earlier application whose priority has been claimed (Rule 66.7(b)).

2. ☐ This report has been established as if no priority had been claimed due to the fact that the priority claim has been found invalid (Rule 64.1).

Thus for the purposes of this report, the international filing date indicated above is considered to be the relevant date.

3. Additional observations, if necessary:

Priority is considered valid, therefore document WO9931911 is of no relevance.

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International application No.
PCT/FI99/00868

V. Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N)	Claims	1-14	YES
	Claims		NO
Inventive step (IS)	Claims	1-14	YES
	Claims		NO
Industrial applicability (IA)	Claims	1-14	YES
	Claims		NO

2. Citations and explanations (Rule 70.7)

The claimed invention concerns a digital telecommunication system wherein terminals and network comprise speech codecs. In a call between two mobile stations, the mobile switching centres of the calling and called mobile stations use mutual signalling to agree upon the speech codec to be used on a call connection, and the network connects a transcoder for a speech connection only when required. The signalling simplifies implementation of a tandem free function, as transcoders are no longer automatically part of the transmission path.

In the search report two documents of particular relevance are cited, namely:

D1 US 5608779
D2 US 5768308

D1 describes a communication system where mobile switching centres instruct transcoders to operate in a transparent mode when a call is a mobile-to-mobile call. In a transparent mode the transcoders let the encoded speech through without speech encoding operations, so that speech is encoded and decoded only in the terminals. See column 2, line 47 - column 3, line 17 and column 8, line 35 - column 9, line 62.

D2 relates to a similar system, where two bypass-capable digital signal processors are arranged on the switch side of the network system. Codec bypass occurs when a signal processor is directly linked with another in a mobile-to-mobile connection. Upon successful handshakes, each signal processor activates the codec bypass mechanism to transmit the mobile audio signal in VSELP format to the other processor. The communication process is done via inband signalling. See column 3, line 55 - column 4, line 57.

.../...

Supplemental Box
(To be used when the space in any of the preceding boxes is not sufficient)

Continuation of: V

The system according to claim 1 and the centre according to claim 14 differ from the known systems in that the calling terminal informs the called terminal about the speech codecs supported by the terminal in order to enable the terminals to choose a common speech codec. A further difference is that the centre connects a transcoder for a speech connection when required, while in D1 and D2 the centre bypasses the transcoders when it is not necessary to use them. Thus, if the terminals can agree on a common voice codec, no transcoder needs to be connected for a speech connection.

Further, none of the cited documents disclose a system where terminals support several speech codecs, and therefore there is no need for agreeing on the speech codec to be used in a tandem-free operation mode. Consequently, there are no indications in either of the documents that would lead a person skilled in the art to the claimed invention.

Therefore, the system according to claims 1 - 13 and the centre according to claim 14 are novel, involve an inventive step and have industrial applicability.

VI. Certain documents cited

1. Certain published documents (Rule 70.10)

Application No. Patent No.	Publication date *(day/month/year)*	Filing date *(day/month/year)*	Priority date (valid claim) *(day/month/year)*
WO9931911	24/06/99	16/12/1998	17/12/1997

2. Non-written disclosures (Rule 70.9)

Kind of non-written disclosure	Date of non-written disclosure *(day/month/year)*	Date of written disclosure referring to non-written disclosure *(day/month/year)*

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(71) Applicant *(for all designated States except US)*: NOKIA NETWORKS OY [FI/FI]; Keilalahdentie 4, FIN–02150 Espoo (FI).

(72) Inventor; and
(75) Inventor/Applicant *(for US only)*: VERKAMA, Markku [FI/FI]; Hakamäki 2 A 12, FIN–02120 Espoo (FI).

(74) Agent: KOLSTER OY AB; Iso Roobertinkatu 23, P.O. Box 148, FIN–00121 Helsinki (FI).

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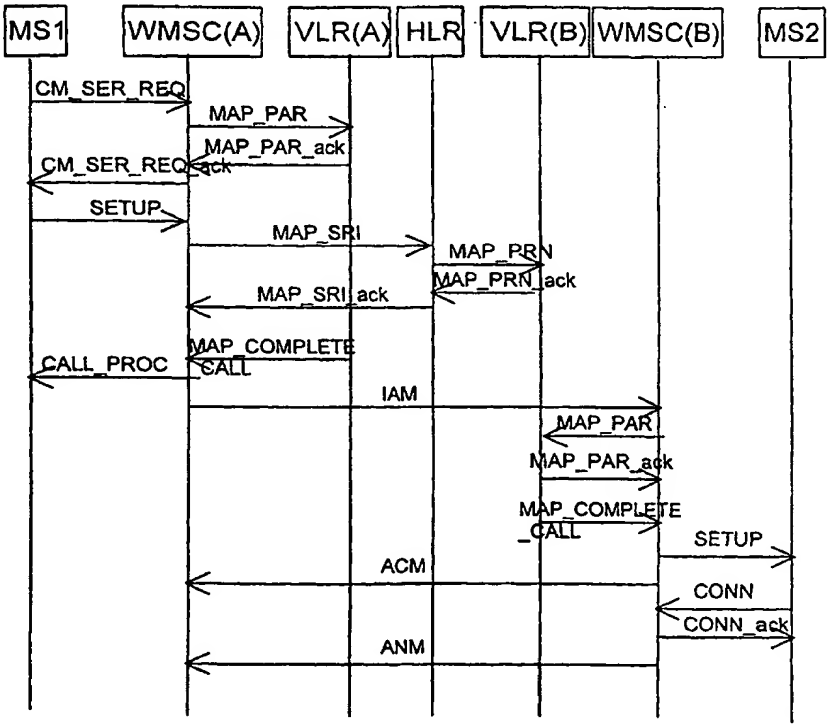
Published
With international search report.
Before the expiration of the time limit for amending the claims and to be republished in the event of the receipt of amendments.

(54) Title: DIGITAL TELECOMMUNICATION SYSTEM

(57) Abstract

A digital telecommunication system wherein the telecommunications centres of the calling and called terminal are arranged to perform handshaking concerning the speech codec used by the terminals. Depending on the link between the telecommunications centres, the telecommunications centres are arranged to connect call connections past a transcoder unit or to control the transcoder units to let encoded speech through without speech encoding operations in such a way that speech encoding and decoding are carried out only in the terminals. Handshaking between the telecommunications centres is carried out as outband signalling.



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DIGITAL TELECOMMUNICATION SYSTEM

The invention relates to a digital telecommunication system wherein terminals and a telecommunication network comprise speech codecs, the speech codecs of the telecommunication network being located in a transcoder unit, from which a centre in the telecommunication network connects a transcoder to a speech connection, when required.

In present digital mobile communication systems, speech and data are transferred entirely in digital form, resulting in a uniformly good quality of speech. As far as the mobile communication network is concerned, the most limited resource on a transmission path is the radio path between mobile stations and base stations. To make the bandwidth required by one radio connection on the radio path as narrow as possible, speech encoding is employed in speech transmission to allow significantly lower transmission rates than in a fixed telephone network (PSTN, Public Switched Telephone Network), for example. In this case a speech encoder and decoder have to exits both in the mobile station and on the side of the fixed mobile communication network. On the network side, speech encoding functions may be placed alternatively either in a base station or a mobile switching centre. Speech encoders and decoders are typically located far away from the base station, in what is known as remote transcoder units, speech encoding parameters being transferred in the network between a base station and the transcoder unit. Thus a transcoder unit is a part of the logical transmission path in a fixed mobile communication network from a base station to a mobile switching centre.

In mobile terminated (MT) or mobile originated (MO) speech calls, a transcoder is connected to the speech connection on the network side for encoding (downlink) speech signals destined to a mobile station and decoding (uplink) speech signals originating from a mobile station. This is necessary if one of the parties to a call is a mobile station and the other a subscriber in a public telephone network (PSTN), for example.

In the case of mobile-to-mobile calls (MMC), the above described connection of a transcoder to a call results in the mobile switching centre connecting two transcoder units in series to each MMC call, two speech encodings and decodings being performed on the call in the above described manner. This so-called tandem coding is a problem in mobile communication networks, since it weakens speech quality owing to the extra speech encoding and decoding. Consequently, methods for preventing tandem coding have

been developed in present digital mobile communication systems, for example the GSM system (Global System for Mobile communication). Methods of creating a tandem free function are based on signalling in a mobile communication network, the signalling comprising forwarding an indication to the transcoders upon set-up of an MMC call to the effect that they are to operate in a tandem coding prevention mode, whereby the transcoder does not at all encode or decode speech. Said signalling is transferred on a speech channel with speech parameters and other control information, i.e. as inband-signalling. In the tandem coding prevention mode, speech is encoded only in mobile stations and speech parameters are only transferred through the mobile communication network with slight changes from one base station via two tandem-connected transcoders to a second base station. This considerably improves the quality of speech as compared with a tandem coded MMC call.

In mobile communication networks, circuit-switched technology based on pulse code modulation (PCM) has been conventionally used in inter-MSC data transmission, i.e. PSTN or ISDN-based (Integrated Services Digital Network) network solutions. In this case, when a transcoder is in a tandem coding prevention mode, it combines control, synchronization and error correction information, for example, with speech parameters arriving from a mobile station via a base station, and adapts the data to PCM timeslots without transcoding. In mobile stations, encoded speech is adapted to a PCM channel such that one or more least significant bits of PCM samples constitutes a subchannel into which lower-rate speech encoded by the mobile station is multiplexed. These PCM samples and their subchannels are transferred to the receiving transcoder which sends the speech parameters further to the receiving base station either as such or making slight changes indicated by the control information. Inter-MSC data transmission on a PCM channel is described in greater detail in the Applicant's previous Finnish patent application 960,590.

The above manner of arranging tandem coding prevention is a well working method in mobile communication systems in which transcoders are part of the transmission path of the mobile communication network, and in which PCM technology is used in inter-MSC data transmission. However, in future third generation mobile communication systems, the intention is not to place transcoders as part of the transmission path, but they are to be placed in what is known as a transcoder pool, in association with a mobile switching centre, for example. In this case the mobile switching centre connects a

transcoder to a call only if it is necessary, whereby the above manner of signalling a tandem coding prevention mode and adaptation of control information to speech parameters is not an advantageous way to implement a tandem free function. In third generation mobile communication systems, various alternative technologies are available for inter-MSC data transmission, including packet-switched connections not based on pulse code modulation. In this case it is not necessary to transmit inter-MSC signalling as part of a speech channel, which allows a simpler implementation of the tandem free function.

It is an object of the present invention to prevent tandem coding in calls between mobile stations by the use of simplified signalling better adaptable to new systems, in which the speech codec to be used is agreed upon between mobile switching centres.

The digital telecommunication system of the invention is characterized in that

the centre of the calling terminal is arranged to perform handshaking with the centre of the called terminal concerning the speech codec used by the terminals, and

the centres are arranged to establish call connections past the transcoder unit or to control the transcoder units to let the encoded speech through without speech encoding operations so that speech is encoded and decoded only in the terminals.

It is an essential idea of the invention that in a call between two mobile stations, the mobile switching centres of the calling and called mobile stations use mutual signalling to agree upon the speech codec to be used on a call connection. It is the idea of a preferred embodiment of the invention that, depending on the connection between the mobile switching centres, no transcoder is connected to the call connection. It is the idea of another preferred embodiment of the invention that said signalling is what is known as outband signalling.

It is an advantage of the invention that the signalling of the invention simplifies implementation of the tandem free function, as transcoders are no longer automatically part of the transmission path. The signalling of the invention provides a common starting point for inter-MSC transmission of a call between two mobile stations irrespective of what kind of a connection is in use between the mobile switching centres. It is a further advantage of a preferred embodiment of the invention that, since, depending on the connection

between the mobile switching centres, no transcoder is connected to the call connection, speech parameters do not have to be adapted to PCM frames as is the case in present transcoders. Neither do the transcoders necessarily have to support a speech codec to be used in calls between two mobile stations, and consequently mobile station-specific speech codecs can be rapidly taken into use in new systems. Still another advantage of the invention is that present network elements and signalling architecture in a mobile communication network can be used. New signalling messages, for example, do not have to be created for implementing the invention, but the invention can be implemented by modifying the contents of existing messages.

In the following the invention will be described in greater detail with reference to the accompanying drawings, in which

Figure 1 is a simplified block diagram of an architectural model of a third generation mobile communication system,

Figure 2 shows a transport cell according to a packet-switched transmission method which can be utilized in a preferred embodiment of the invention,

Figure 3 shows an adaptation protocol function of a packet-switched transmission method which can be utilized in a preferred embodiment of the invention,

Figure 4 shows protocol layers of a packet-switched transmission method which can be utilized in a second preferred embodiment of the invention, and

Figure 5 shows call set-up signalling according to some preferred embodiments of the invention.

In this context, the term speech codec, or simply codec, refers to a functional entity which serves to encode or decode speech into a form required by a mobile communication system.

Figure 1 is a simplified block diagram of an architectural model of a third generation mobile communication system. The design of core network solutions in third generation mobile communication systems is based on the present European digital mobile communication system GSM. This allows the use of present core network solutions also in the future almost as such, and only changes required by new functions and services will be made. This provides considerable savings, since the expensive core networks do not have to be completely rebuilt. This is why reference is made in the examples of the

present description, when applicable, to the present GSM system, since, for the most part, the principals of the signalling inside the core network will remain the same.

In Figure 1, a mobile station (MS) communicates with a wideband mobile services switching centre (WMSC) via a radio access network (RAN). The radio network RAN comprises a base station system (not shown) comprising base transceiver stations (BTS) and radio network controllers (RNC), and signalling between them, but as far as the invention is concerned, the radio network may also be structurally different. Wideband CDMA technology, i.e. WCDMA technology, is used at the radio interface between the mobile station MS and the radio network RAN. However, the radio technology used is not relevant to the invention, and consequently the invention can also be used in systems applying other technologies. The radio network RAN communicates with the mobile switching centre WMSC over a radio interface Iu, for whose standards the ETSI (European Telecommunications Standards Institute) is currently drawing up recommendations. The mobile switching centres WMSC also have visitor location registers (VLR) and transcoder units (TCU). The mobile switching centres WMSC signal to a home location register (HLR) information on the user of the mobile station, i.e. the subscriber, concerning access rights, functions and charging, for example. MAP (Mobile Application Part) is the abbreviation generally used for referring to this signalling and it is described in greater detail in GSM recommendation 09.02 *Mobile Application Part (MAP)*. Said subscriber data is also stored in the visitor location register VLR when a mobile station MS visits the area of the corresponding mobile switching centre WMSC.

In a preferred embodiment of the present invention, mobile switching centres agree by mutual handshaking signalling upon the speech codec to be used in an MMC call between two mobile stations, MS1 and MS2, whereupon, depending on the connection between the mobile switching centres, the call is either connected past the transcoder unit or the transcoder unit is controlled to let the call pass through without speech encoding functions on the mobile communication network side in such a manner that speech is encoded and decoded only in the mobile stations MS1 and MS2. According to the invention, this is achieved by indicating the speech codecs supported by the mobile station MS1 of subscriber A to the mobile switching centre WMSC(A) of subscriber A. The mobile switching centre WMSC(A) stores this information

in the visitor location register VLR(A), attaches said information as part of a routing information inquiry to be sent to the home location register HLR, and the home location register HLR relays the information further to the mobile switching centre WMSC(B) of subscriber B. Subscribers A and B may also be attached to the same mobile switching centre, in which case the routing information inquiry does not have to be sent via the home location register HLR, but it can be made via the visitor location register VLR in association with the mobile switching centre WMSC. The speech codecs supported by the mobile station MS2 of subscriber B are also indicated to the mobile switching centre WMSC(B) of subscriber B, and the mobile switching centre WMSC(B) stores this information in the visitor location register VLR(B). The mobile switching centre WMSC(B) of subscriber B selects a codec suitable for both mobile stations, MS1 and MS2, informs the mobile switching centre WMSC(A) of subscriber A, and stores the information on the codec to be used in its database VLR(B).

In a preferred embodiment of the present invention, an MMC call between two mobile stations MS1 and MS2 can be so switched that no transcoder at all is connected to the connection. This is carried out as follows: after the above described signalling, the mobile switching centres having agreed upon the speech codec to be used on the call connection, the mobile switching centre WMSC(A) checks the transmission technology the connection uses between the mobile switching centres WMSC(A) and WMSC(B). If pulse code modulation is not used on said connection, i.e. the connection is packet-switched, for example, then, in response to this, the mobile switching centre WMSC(A) connects no transcoder to the connection. Alternatively, the connection between the mobile switching centres WMSC(A) and WMSC(B) may be a PCM-switched PSTN or ISDN connection. In this case the mobile switching centre WMSC(A) controls the transcoder unit TCU(A), in a manner known per se, to switch the call connection via the transcoder without speech encoding functions in such a way that speech is encoded and decoded only in the mobile stations MS1 and MS2.

Third generation mobile stations use various speech 1codecs, and in MMC calls, to which no transcoder is connected in the above manner, it is essential that mobile stations use the same kind of speech codec. According to a preferred embodiment of the invention, the speech codec to be used is indicated, when required, to both mobile stations before the call is switched. A

default codec to be used by the mobile stations MS1 and MS2, unless otherwise notified, is preferably defined. Similarly, the visitor location registers VLR(A) and VLR(B) comprise information on the default speech codecs. Should the above handshaking signalling result in the use of another speech codec on the call connection than is the default set for the mobile stations MS1 or MS2, information on this is forwarded to the mobile switching centres WMSC(A) and WMSC(B). Finally, when the call is set up, the mobile switching centres WMSC(A) and WMSC(B) inform the mobile stations MS1 and MS2, respectively, which codec to use, should it not be the default codec.

In accordance with a second preferred embodiment of the invention, handshaking signalling concerning the speech codec to be used is carried out as part of physical call set-up. In this case the speech codec to be used is notified to the mobile switching centre WMSC(A) in a reply message to a call set-up message, whereupon the mobile switching centres WMSC(A) and WMSC(B) inform, when required, the mobile stations MS1 and MS2 about the codec to be used, and control the transcoder units TCU(A) and TCU(B) in a manner required by the transmission connection, as was described above.

In third generation mobile communication networks, inter-WMSC traffic is designed to be carried out by packet-switched connections, when possible. In other words, it can be preferably carried out by means of wideband ATM network technique (Asynchronous Transfer Mode), for example. ATM is a general-purpose transfer mode which combines the advantages of circuit-switched and packet-switched data transmission. ATM is based on cell-switched data transmission, the data to be transmitted being split into bits having a given length, i.e. cells. Telecommunication applications which require constant capacity or delay and which have conventionally used a circuit-switch connection, are prioritized in filling the cells. Applications not requiring constant capacity or delay, transmit their data in the remaining cells in the same way as on a packet-switched connection.

An ATM cell comprises 53 bytes, of which 48 bytes are payload and 5 bytes are reserved for header data. Figure 2 shows an ATM cell and its header fields. A GFC field (Generic Flow Control) is used in connection flow control. A virtual path identifier (VPI) indicates to the ATM network switches the route of the cell in the network, cells having the same VPI value being always transmitted to the same address. A virtual channel identifier (VCI) operates like the VPI, and both VPI and VCI values are used in defining a logical

channel, allowing the simultaneous connection of whole channel groups to the backbone network. Hereby the VPI between two functional points can be agreed upon among service providers, and yet the service user is able to define the VCI values. The type of payload is defined in a PT field (Payload Type). A CLP field (Cell Loss Priority) allows traffic to be divided into two classes, resulting in the cells whose CLP bit = 1 being destroyed first when the network gets congested. An HEC field (Header Error Correction) is used to ascertain the correctness of header bits.

ATM technique can be utilized in various applications, and therefore the need has arisen to define adaptation protocols (AAL, ATM Adaptation Layer) for different application types. Figure 3 shows an AAL function in which a data packet originating from a mobile switching centre, for example, is split in the ATM adaptation function into 48-byte cells, which are further applied to ATM circuits, which attach a five-byte header to the cells. In the physical access layer these cells are further set into an SDH form (Synchronous Digital Hierarchy), which specifies in optical fibre-based transmission systems how data streams at different rates are transmitted in the backbone network. The ATM backbone network is composed of ATM switches, which are linked together by high-rate connections, usually optical fibres, and to which local networks, mobile switching centres, telephone exchanges or video devices, for example, can be further connected. In present ATM networks, the transfer rate may vary, depending on the connection, between 64 kbps and 622 Mbps, but in the future several Gbps will be reached. As to a more precise description of the ATM technique, reference is made to *'Asynchronous Transfer Mode: Atm Architecture and Implementation'*; J. Martin, K. Chapman, J. Leben; Prentice Hall, USA; ISBN: 0135679184.

During the last few years, the use of the Internet has grown exponentially and become more versatile, new services and options being continuously developed. The TCP/IP protocol (Transmission Control Protocol/Internet Protocol) acts as the data transmission protocol in the Internet, the special advantage being its independence of different device or software architectures, which makes it the most generally used network protocol in the world, especially in local networks. In Internet-based networks, the IP protocol is the actual network protocol which serves to route an addressed IP message from a source station to a destination station. A transport protocol, either TCP or UDP (User Datagram Protocol), is run above the IP network protocol. The

transport protocol attends to the transfer of data packets from a source port to a destination port. The TCP offers reliable connections to applications, i.e. the TCP splits the data from the applications into IP packets, sees to it that the data arrives intact and in the right order, resends lost or damaged data packets and also attends to flow control. The UDP, in turn, is a lighter transport protocol than the TCP and does not answer for the arrival or correctness of data packets. This makes the UDP an unreliable transport protocol, which leaves error and correctness checks to the application program, but is better suited to services requiring real-time performance.

The generality of Internet-based networks and the inexpensive, in local networks even free data transmission, they offer, have aroused great interest in switching also voice calls via IP networks. This would also allow inter-MSC data to be transmitted by means of IP networks. The device and system solutions thus far developed for transmitting conventionally circuit-switched voice calls in a packet-switched IP network are rather unreliable and incompatible. To make Internet call systems compatible, a standard (VoIP, Voice over IP) is being created, for example for determining the compatibility of devices, quality of service, and routing calls in IP networks.

Figure 4 shows a VoIP standard recommendation for the protocol stack in Internet call systems. Either the TCP or the UDP is run above the IP network protocol, depending on the application. At the next layer, an H.323 protocol stack is placed; a standard defined by the ITU (International Telecommunication Union) for packing voice and video image used in video conference programs and for controlling calls. The H.323 is used for call set-up and adaptation negotiations, and for reserving a connection required by real-time speech in an IP network. Call control and functions and services associated therewith, such as choice of transfer protocol, optional speech encoding, voice activity detection (VAD) and DTMF functions, are carried out in a CMAS unit (Call Management Agent System) comprising CMA framing and agents for each function (Basic Agents). The CMAS utilizes the LDAP (Lightweight Directory Access Protocol) for dealing with the name service in telecommunications between different types of networks and file servers without the transport protocol having to deal with it. An external telephone network, for example a mobile telephone network, can be linked to the VoIP system by means of an H.323 gateway server (not shown). In fact, a mobile telephone operator is able to best utilize the VoIP system in his own local or wide area network

(LAN/WAN), allowing the operator to manage traffic both in the network and in the H.323 gateway servers.

Data transmission protocols based on the ATM and IP technologies are presented herein by way of example as data transmission technologies advantageous to the implementation of the invention. They use packet-switched data transmission, i.e. data frames are not adapted to PCM timeslots. This provides the advantage that, as no adaptation to PCM frames is required, a call can be set up completely without transcoders. Inter-MSC handshaking signalling can also be carried out as outband signalling, allowing the handshaking signalling to be carried out separately from call set-up, for example directly in inter-MSC connection set-up. It is obvious that the mobile communication system of the invention can be implemented by the use of any corresponding packet-switched data transmission technology, e.g. by means of xDSL technology (Digital Subscriber Line).

In the following, a preferred embodiment of the invention will be described with reference to Figure 5. Figure 5 only shows the relaying of messages relevant to the implementation of the invention in a mobile communication system. Consequently, between the messages described, messages may be relayed that are not essential to the implementation of the invention. The speech codecs supported by the mobile station MS1 of subscriber A are indicated to the mobile switching centre WMSC(A). This may preferably take place during call set-up signalling as the mobile station MS1 requests connection set-up of the mobile communication network, whereby the mobile switching centre WMSC(A) can store the data on the speech codecs supported by the mobile station MS1 in the visitor location register VLR(A). For data transmission a classmark identifier can also be used, which is known for example from the GSM system and comprises data on the properties of a mobile station and which the mobile station sends to the network when requested or when the mobile station wants to change classmark classes. Similarly, the speech codecs supported by the mobile station MS2 of subscriber B are indicated to the mobile switching centre WMSC(B). Relaying call set-up signalling and classmark identifiers is described in greater detail in GSM recommendation 04.08 *Mobile radio interface layer 3 specification*.

When subscriber A initiates call set-up, the mobile station MS1 sends via the radio network RAN to the mobile switching centre WMSC(A) a call setup message, on the basis of which the mobile switching centre

WMSC(A) identifies the called subscriber B as a mobile station. Subscriber B is identified on the basis of a numerical analysis, the identification being known per se from optimal call routing (OR), for example. In accordance with Figure 5, the mobile switching centre WMSC(A) receives a CM_SER_REQ message (Connection Management_Service_Request), for example, as a sign of initiation of call set-up. In order for the call to be able to be routed to subscriber B via the right mobile switching centre WMSC(B), the mobile switching centre WMSC(A) sends to the home location register HLR a routing information inquiry MAP_SRI (MAP_Send_Routing_Information), to which is attached information on the speech codecs supported by the mobile station MS1, preferably in the preference order of the mobile station MS1. The preference order serves to always use the default speech codecs of mobile stations, as far as is possible. The home location register HLR attaches this information further as part of a roaming number inquiry sent to the visitor location register VLR(B) of the mobile switching centre WMSC(B), MAP_PRN (MAP_Provide_Roaming_Number). The mobile switching centre WMSC(B) selects from the speech codecs informed the one that is suitable for the mobile station MS2, making the selection preferably in the preference order given by the mobile station MS1. Information on the speech codec selected is stored in the visitor location register VLR(B) and attached to a roaming number reply MAP_PRN_ack sent to the home location register HLR. The home location register HLR further attaches the information to a reply message to the routing information inquiry, MAP_SRI_ack, which is sent to the mobile switching centre WMSC(A) which stores the information in the visitor location register VLR(A).

As call set-up progresses, the mobile switching centre WMSC(B) sends to the visitor location register VLR(B) an inquiry of necessary authentication and encryption information. The corresponding inquiry for subscriber A is already made at the initial stage of call set-up in a message MAP_PAR-(MAP_Process_Access_Request). To initiate actual call switching, both visitor location registers VLR(A) and VLR(B) issue to the mobile switching centres WMSC(A) and WMSC(B), respectively, a command MAP_COMPLETE_CALL, to which information on the speech codec selected for that call connection is attached. If the speech codec selected for the call connection is not the default speech codec of mobile stations MS1 or MS2, the mobile switching centres transmit information on the selected speech codec further to the mobile stations. Then, in the MO section of the call, the WMSC(A) indicates the in-

formation to the MS1 in a message CALL_PROC and, similarly, in the MT section of the call, the WMSC(B) indicates the information to the MS2 in a SETUP message. In response to this, both mobile stations MS1 and MS2 connect the same speech codec to the call.

Now, if packet-switched ATM technology, for example, is used on the connection between the mobile switching centres WMSC(A) and WMSC(B) instead of data transmission based on circuit-switched PCM technology, no transcoder at all is connected to the connection, but the speech frames encoded by the mobile station MS1 by means of the above AAL function of the ATM, suitable for the mobile switching centre, are placed in ATM cells. Similarly, when the VoIP technology is used, speech frames are placed by means of the H.323 gateway server into H.323 frames complying with the VoIP standard. In this case, as far as the fixed mobile communication network is concerned, speech frames are transmitted in the exact speech frame form encoded by the mobile station. If again the inter-MSC connection utilizes the PSTN or ISDN technology, the mobile switching centres connect transcoders to the connection and control these to adapt the speech frames encoded by the mobile station to the PCM form required by the PSTN and ISDN technologies, however, without transcoding. In this case the adaptation function carried out by the transcoders corresponds to the tandem free function of the known GSM technology.

A second preferred embodiment of the invention can be implemented in a mobile communication system allowing direct signalling on an inter-MSC connection. One such signalling model is what is known as ISUP signalling (ISDN User Part), usable in inter-MSC signalling. ISUP signalling is described in greater detail in the ITU standard recommendations Q.721-Q.764. In accordance with Figure 5, in inter-MSC signalling three ISUP messages are used: IAM (Initial Address Message), ACM (Address Complete Message) and ANM (Answer Message). In accordance with the invention, the speech codecs supported by subscriber A are then notified to the mobile switching centre WMSC(B) of subscriber B in an IAM message, allowing non-defined spare values of the IAM message to be advantageously utilized. The mobile switching centre WMSC(B) of subscriber B sends an ACM message to the mobile switching centre WMSC(A) after a SETUP message sent to the mobile station MS2. The mobile switching centre WMSC(B) and the mobile station MS2 set up the connection by messages CONN (Connect) and

CONN_ack. The mobile switching centre WMSC(B) selects the speech codec in the same way as was described above and attaches information on the speech codec selected as part of an ANM message sent to the mobile switching centre WMSC(A).

In the present embodiment of the invention, information on the speech codec selected is not transferred to the mobile switching centre WMSC(A) of subscriber A until the physical transmission path has been set up. Consequently, in an MMC call between two mobile stations MS1 and MS2, the transcoder units in the mobile switching centres are not controlled to switch the call past the transcoder unit or to control the transcoder unit to let the call through without speech encoding operations until after connection set-up. In other respects than the handshaking signalling of the speech codecs and the control of the transcoder units, this embodiment of the invention can be implemented in the same way as was described above. The implementation of this embodiment of the invention also allows the use of any other inter-MSC signalling, such as TUP signalling (Telephone User Part).

The invention and the signalling associated therewith have been described herein according to potential embodiments of the invention and only to the degree that the description of the signalling is relevant to the implementation of the invention. As to a more precise description of signalling, particularly as to functions under malfunction, reference is made to the GSM recommendation 09.02 *Mobile Application Part (MAP)*, Chapter 18, *'Call Handling Procedures'* (v. 4.18.0).

Even though the invention has been described herein with mobile communication systems as the basis, the principles of the invention can be implemented in any corresponding telecommunication system in which centres perform handshaking concerning speech codecs used by terminals. The invention is particularly applicable in mobile communication systems, since said environment uses a plurality of different terminals in which a plurality of different speech encoding methods are used, the interfaces between the terminals and the network being accurately standardized.

The figures and the related specification are only intended to illustrate the present invention. It is obvious to a person skilled in the art that the details of the invention may be implemented in a variety of ways within the scope of the attached claims.

CLAIMS

1. A digital telecommunication system wherein terminals and a telecommunication network comprise speech codecs, the speech codecs of the telecommunication network being disposed in a transcoder unit, from which a centre in the telecommunication network connects a transcoder for a speech connection, when required, **characterized** in that

the centre of the calling terminal is arranged to perform handshaking with the centre of the called terminal concerning the speech codec used by the terminals, and

the centres are arranged to establish call connections past the transcoder unit or to control the transcoder units to let the encoded speech through without speech encoding operations so that speech is encoded and decoded only in the terminals.

2. A telecommunication system as claimed in claim 1, **characterized** in that

said telecommunication system is a mobile communication system in which said terminals comprise mobile stations, said telecommunication network comprises a mobile communication network and said centre of the telecommunication network comprises a mobile switching centre.

3. A telecommunication system as claimed in claim 2, **characterized** in that

the mobile switching centre comprises a subscriber database for maintaining subscriber data on a mobile subscriber when the mobile station is located within the area of the mobile switching centre, and

said subscriber data comprises information on the speech codecs supported by the subscriber's mobile station.

4. A telecommunication system as claimed in any one of claims 1 to 3, **characterized** in that

said handshaking is carried out as outband signalling.

5. A telecommunication system as claimed in claim 4, **characterized** in that

the mobile switching centres are arranged to carry out said handshaking in association with a routing information inquiry in response to the called subscriber being a mobile subscriber.

6. A telecommunication system as claimed in claim 5, **characterized**

terized in that

the mobile switching centre of the calling subscriber is arranged to send a routing information inquiry comprising information on the speech codecs supported by the mobile station,

the mobile switching centre of the called subscriber is arranged to select for the call connection a speech codec which the mobile stations of both the called and calling subscribers support, and

the mobile switching centre of the called subscriber is arranged to send information on said speech codec, selected for the call connection, in a reply message to the routing information inquiry.

7. A telecommunication system as claimed in claim 6, **characterized** in that

said routing information inquiry and reply message to the routing information inquiry are arranged to pass via the home database of the called subscriber.

8. A telecommunication system as claimed in claim 4, **characterized** in that

the mobile switching centres are arranged to carry out said handshaking in association with inter-MSC signalling, such as ISUP signalling.

9. A telecommunication system as claimed in claim 8, **characterized** in that

the mobile switching centre of the calling subscriber is arranged to send a message requesting connection set-up, such as an IAM message according to ISUP signalling, the message containing information on the speech codecs supported by the mobile station,

the mobile switching centre of the called subscriber is arranged to select for the call connection a speech codec which the mobile stations of both the called and calling subscribers support, and

the mobile switching centre of the called subscriber is arranged to send information on said codec, selected for the call connection, in a reply message to the connection set-up message, such as in an ANM message according to ISUP signalling.

10. A telecommunication system as claimed in any one of the preceding claims, **characterized** in that

when required, at least one of the mobile switching centres is arranged to notify the mobile station of the speech codec it has to use as the

result of said handshaking.

11. A telecommunication system as claimed in claim 10, **characterized** in that

the mobile switching centre is arranged to notify the mobile station of the speech codec to be used if it is not the default speech codec of the mobile station.

12. A telecommunication system as claimed in any one of the preceding claims, **characterized** in that

a pulse code modulated (PCM) digital link exists between the mobile switching centres, and

the mobile switching centres are arranged to control the transcoder units at the ends of said link to adapt the encoded speech signal to one or more least significant bits of PCM samples without transcoding.

13. A telecommunication system as claimed in any one of claims 1 to 11, **characterized** in that

a packet-switched link exists between the mobile switching centres, such as a network based on the ATM or IP technology, and

the mobile switching centres are arranged to connect a call connection past the transcoder unit.

14. A centre in a digital telecommunication network, the centre being arranged to connect a transcoder located in a transcoder unit to a call connection when required, **characterized** in that

said centre is arranged to perform handshaking with the centre of a called terminal concerning the speech codec used by the terminals, and

said centre is arranged to connect a call connection past the transcoder unit or to control the transcoder unit to let the encoded speech through without speech encoding operations in such a way that speech encoding and decoding are only carried out in the terminal.

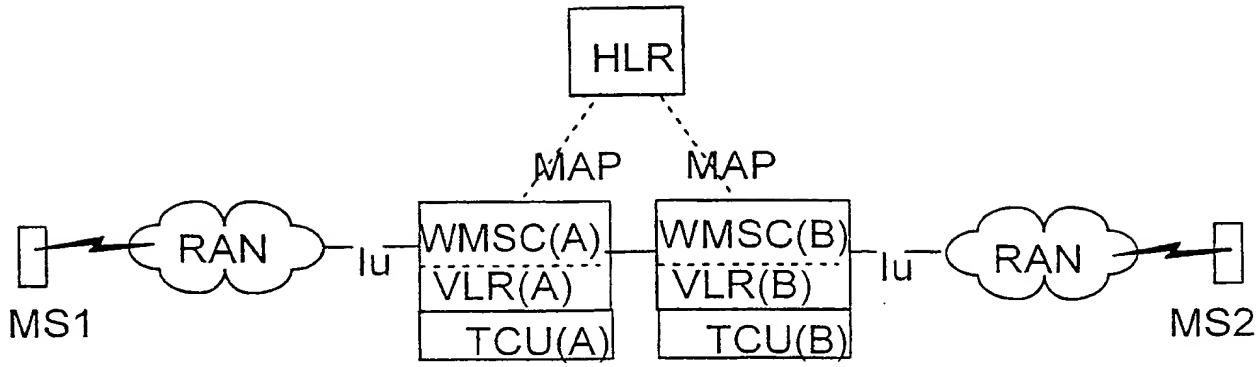

FIG. 1

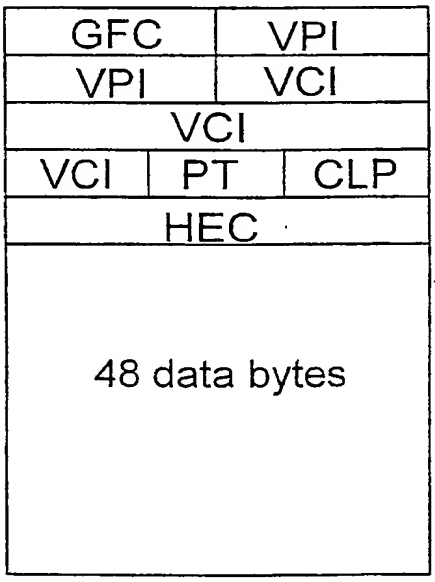

FIG. 2

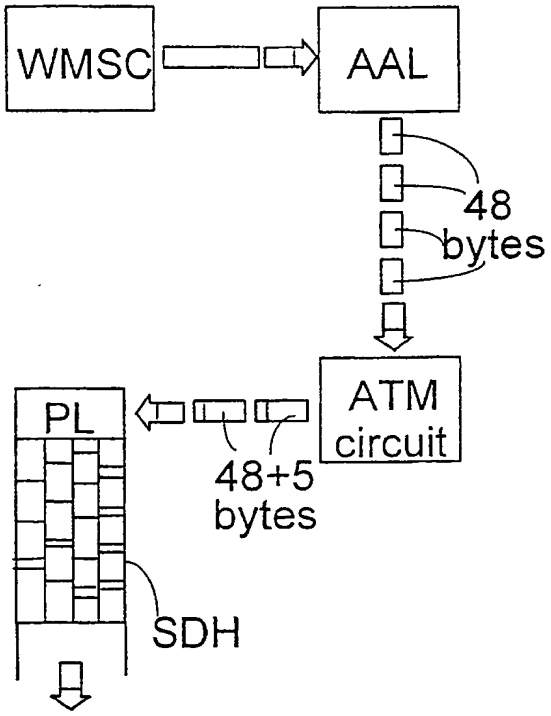

FIG. 3

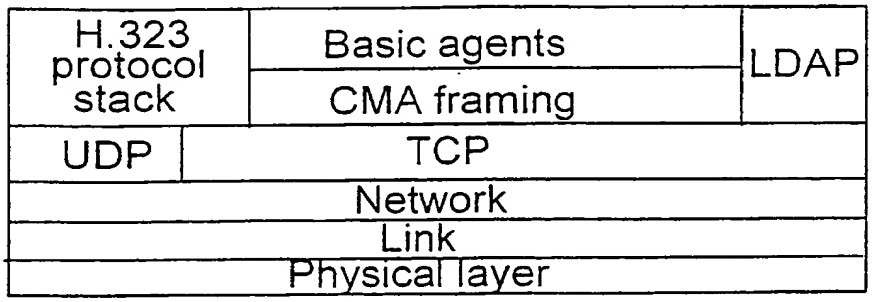

FIG. 4

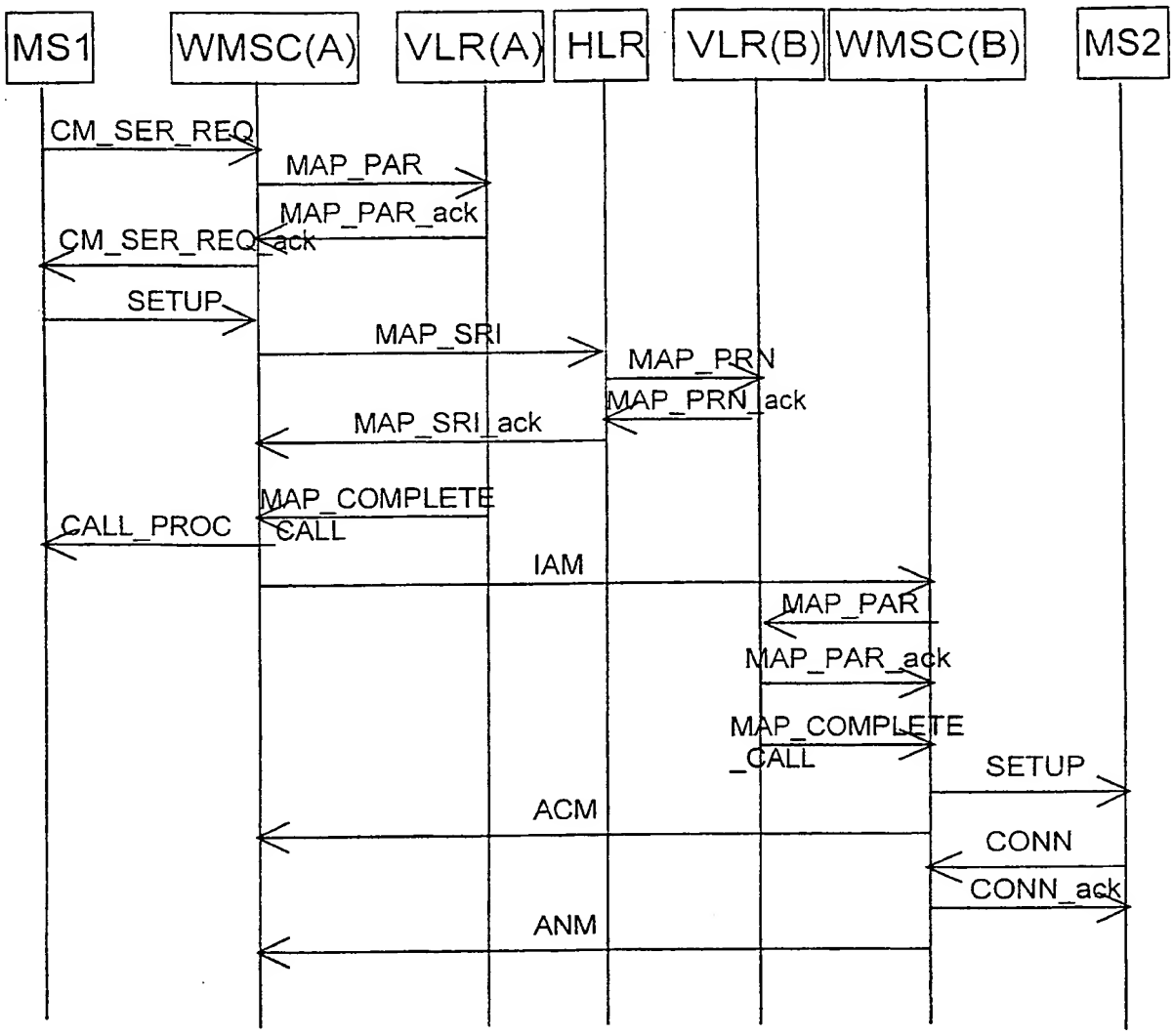
MS1
WMSC(A)
VLR(A)
HLR
VLR(B)
WMSC(B)
MS2
CM_SER_REQ
MAP_PAR
MAP_PAR_ack
CM_SER_REQ_ack
SETUP
MAP_SRI
MAP_PRN
MAP_PRN_ack
MAP_SRI_ack
MAP_COMPLETE
CALL_PROC
CALL
IAM
MAP_PAR
MAP_PAR_ack
MAP_COMPLETE
_CALL
SETUP
ACM
CONN
CONN_ack
ANM

FIG. 5

INTERNATIONAL SEARCH REPORT

International application No.
PCT/FI 99/00868

A. CLASSIFICATION OF SUBJECT MATTER

IPC7: H04Q 7/22, H04M 7/00
According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC7: H04Q

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

SE,DK,FI,NO classes as above

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

WPI EPODOC PAJ

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 5608779 A (V.LEV ET AL), 4 March 1997 (04.03.97), column 2, line 47 - column 3, line 17; column 4, line 61 - column 5, line 12; column 6, line 12 - column 7, line 7	1-5,8,12,14
	--	
X	US 5768308 A (H.PON ET AL), 16 June 1998 (16.06.98), column 3, line 55 - column 4, line 44, claims 1-3, abstract	1,2,12,14
A		3-11,13
	--	
A	DE 19516078 A1 (ROBERT BOSCH GMBH), 7 November 1996 (07.11.96), column 1, line 66 - column 2, line 51, claim 1	1-14
	--	

[X] Further documents are listed in the continuation of Box C. [X] See patent family annex.

* Special categories of cited documents:
"A" document defining the general state of the art which is not considered to be of particular relevance
"E" erlier document but published on or after the international filing date
"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
"O" document referring to an oral disclosure, use, exhibition or other means
"P" document published prior to the international filing date but later than the priority date claimed
"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"X" document of particular relevance: the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"Y" document of particular relevance: the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
27 March 2000	04 -04- 2000
Name and mailing address of the ISA/ Swedish Patent Office Box 5055, S-102 42 STOCKHOLM Facsimile No. +46 8 666 02 86	Authorized officer Gunnel Wästerlid Telephone No. +46 8 782 25 00

INTERNATIONAL SEARCH REPORT

International application No.
PCT/FI 99/00868

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
P,X	WO 9931911 A1 (TELEFONAKTIEBOLAGET LM ERICSSON (PUBL)), 24 June 1999 (24.06.99), page 20, line 7 - page 21, line 34, claims 1,12, abstract	1-3,13,14
P,A	--	4-12
P,A	EP 0909081 A2 (NORTHERN TELECOM LIMITED), 14 April 1999 (14.04.99), column 9, line 5 - line 56; column 11, line 19 - column 13, line 53, abstract	1-14
	--	

INTERNATIONAL SEARCH REPORT

Information on patent family members

02/12/99

International application No.
PCT/FI 99/00868

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 5608779 A	04/03/97	NONE	
US 5768308 A	16/06/98	CA 2207550 A	27/06/96
		CN 1170492 A	14/01/98
		EP 0799554 A	08/10/97
		JP 10500829 T	20/01/98
		WO 9619907 A	27/06/96
DE 19516078 A1	07/11/96	AU 706669 B	17/06/99
		AU 5495496 A	21/11/96
		EP 0824833 A	25/02/98
		HU 9800701 A	28/07/98
		WO 9635299 A	07/11/96
WO 9931911 A1	24/06/99	AU 2054299 A	05/07/99
		DE 19756191 A	24/06/99
EP 0909081 A2	14/04/99	CA 2244007 A	10/04/99

PATENT COOPERATION TREATY

PCT

REC'D 23 FEB 2001
WIPO PCT

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

(PCT Article 36 and Rule 70)

14

Applicant's or agent's file reference	FOR FURTHER ACTION	See Notification of Transmittal of International Preliminary Examination Report (Form PCT/IPEA/416)
2980530PC/TA		
International application No.	International filing date *(day/month/year)*	Priority date *(day/month/year)*
PCT/FI99/00868	19.10.1999	21.10.1998
International Patent Classification (IPC) or national classification and IPC7		
H 04 Q 7/22, H 04 M 7/00		
Applicant		
Nokia Networks OY et al		

1. This international preliminary examination report has been prepared by this International Preliminary Examining Authority and is transmitted to the applicant according to Article 36.

2. This REPORT consists of a total of 6 sheets, including this cover sheet.

   ☒ This report is also accompanied by ANNEXES, i.e., sheets of the description, claims and/or drawings which have been amended and are the basis for this report and/or sheets containing rectifications made before this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions under the PCT).

   These annexes consist of a total of 3 sheets.

3. This report contains indications relating to the following items:

   - I ☒ Basis of the report
   - II ☒ Priority
   - III ☐ Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
   - IV ☐ Lack of unity of invention
   - V ☒ Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
   - VI ☒ Certain documents cited
   - VII ☐ Certain defects in the international application
   - VIII ☐ Certain observations on the international application

Date of submission of the demand	Date of completion of this report
19.05.2000	15.02.2001
Name and mailing address of the IPEA/SE Patent- och registreringsverket Box 5055 S-102 42 STOCKHOLM Telex 17978 PATOREG-S Facsimile No. 08-667 72 88	Authorized officer Gunnel Wästerlid/MN Telephone No. 08-782 25 00

Form PCT/IPEA/409 (cover sheet) (January 1998)

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International application No.
PCT/FI99/00868

I. Basis of the report

1. With regard to the **elements** of the international application:*

☐ the international application as originally filed

☒ the description:
pages 1-13 , as originally filed
pages _____ , filed with the demand
pages _____ , filed with the letter of _____

☒ the claims:
pages _____ , as originally filed
pages _____ , as amended (together with any statement) under article 19
pages _____ , filed with the demand
pages 14-16 , filed with the letter of 05.12.2000

☒ the drawings:
pages 1/2 - 2/2 , as originally filed
pages _____ , filed with the demand
pages _____ , filed with the letter of _____

☐ the sequence listing part of the description:
pages _____ , as originally filed
pages _____ , filed with the demand
pages _____ , filed with the letter of _____

2. With regard to the **language**, all the elements marked above were available or furnished to this Authority in the language in which the international application was filed, unless otherwise indicated under this item.
These elements were available or furnished to this Authority in the following language _____ which is:

☐ the language of a translation furnished for the purposes of international search (under Rule 23.1(b)).

☐ the language of publication of the international application (under Rule 48.3(b)).

☐ the language of the translation furnished for the purposes of international preliminary examination (under Rules 55.2 and/or 55.3).

3. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, the international preliminary examination was carried out on the basis of the sequence listing:

☐ contained in the international application in written form.

☐ filed together with the international application in computer readable form.

☐ furnished subsequently to this Authority in written form.

☐ furnished subsequently to this Authority in computer readable form.

☐ The statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.

☐ The statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished.

4. ☐ The amendments have resulted in the cancellation of:

☐ the description, pages _____

☐ the claims, Nos. _____

☐ the drawings, sheet/fig _____

5. ☐ This report has been established as if (some of) the amendments had not been made, since they have been considered to go beyond the disclosure as filed, as indicated in the Supplemental Box (Rule 70.2 (c)).**

* *Replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are annexed to this report since they do not contain amendments (Rules 70.16 and 70.17).*

** *Any replacement sheet containing such amendments must be referred to under item 1 and annexed to this report.*

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International application No.
PCT/FI99/00868

II. Priority

1. ☐ This report has been established as if no priority had been claimed due to the failure to furnish within the prescribed time limit the requested:

   ☐ copy of the earlier application whose priority has been claimed (Rule 66.7(a)).

   ☐ translation of the earlier application whose priority has been claimed (Rule 66.7(b)).

2. ☐ This report has been established as if no priority had been claimed due to the fact that the priority claim has been found invalid (Rule 64.1).

Thus for the purposes of this report, the international filing date indicated above is considered to be the relevant date.

3. Additional observations, if necessary:

Priority is considered valid, therefore document WO9931911 is of no relevance.

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International application No.
PCT/FI99/00868

V. Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N)	Claims	1-14	YES
	Claims		NO
Inventive step (IS)	Claims	1-14	YES
	Claims		NO
Industrial applicability (IA)	Claims	1-14	YES
	Claims		NO

2. Citations and explanations (Rule 70.7)

The claimed invention concerns a digital telecommunication system wherein terminals and network comprise speech codecs. In a call between two mobile stations, the mobile switching centres of the calling and called mobile stations use mutual signalling to agree upon the speech codec to be used on a call connection, and the network connects a transcoder for a speech connection only when required. The signalling simplifies implementation of a tandem free function, as transcoders are no longer automatically part of the transmission path.

In the search report two documents of particular relevance are cited, namely:

D1 US 5608779
D2 US 5768308

D1 describes a communication system where mobile switching centres instruct transcoders to operate in a transparent mode when a call is a mobile-to-mobile call. In a transparent mode the transcoders let the encoded speech through without speech encoding operations, so that speech is encoded and decoded only in the terminals. See column 2, line 47 - column 3, line 17 and column 8, line 35 - column 9, line 62.

D2 relates to a similar system, where two bypass-capable digital signal processors are arranged on the switch side of the network system. Codec bypass occurs when a signal processor is directly linked with another in a mobile-to-mobile connection. Upon successful handshakes, each signal processor activates the codec bypass mechanism to transmit the mobile audio signal in VSELP format to the other processor. The communication process is done via inband signalling. See column 3, line 55 - column 4, line 57.

.../...

Supplemental Box
(To be used when the space in any of the preceding boxes is not sufficient)

Continuation of: V

The system according to claim 1 and the centre according to claim 14 differ from the known systems in that the calling terminal informs the called terminal about the speech codecs supported by the terminal in order to enable the terminals to choose a common speech codec. A further difference is that the centre connects a transcoder for a speech connection when required, while in D1 and D2 the centre bypasses the transcoders when it is not necessary to use them. Thus, if the terminals can agree on a common voice codec, no transcoder needs to be connected for a speech connection.

Further, none of the cited documents disclose a system where terminals support several speech codecs, and therefore there is no need for agreeing on the speech codec to be used in a tandem-free operation mode. Consequently, there are no indications in either of the documents that would lead a person skilled in the art to the claimed invention.

Therefore, the system according to claims 1 - 13 and the centre according to claim 14 are novel, involve an inventive step and have industrial applicability.

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International application No.
PCT/FI99/00868

VI. Certain documents cited

1. Certain published documents (Rule 70.10)

Application No. Patent No.	Publication date *(day/month/year)*	Filing date *(day/month/year)*	Priority date (valid claim) *(day/month/year)*
WO9931911	24/06/99	16/12/1998	17/12/1997

2. Non-written disclosures (Rule 70.9)

Kind of non-written disclosure	Date of non-written disclosure *(day/month/year)*	Date of written disclosure referring to non-written disclosure *(day/month/year)*

Claims

1. A digital telecommunication system wherein terminals and a telecommunication network comprise speech codecs, the speech codecs of the telecommunication network being disposed in a transcoder unit, from which a centre in the telecommunication network connects a transcoder for a speech connection, when required, **characterized** in that

the centre of the calling terminal is arranged to perform handshaking with the centre of the called terminal, said handshaking including notification of the speech codecs supported by the calling terminal, to choose the speech codec used by the terminals, and

the centres are arranged to establish call connections past the transcoder unit or to control the transcoder units to let the encoded speech through without speech encoding operations so that speech is encoded and decoded only in the terminals.

2. A telecommunication system as claimed in claim 1, **characterized** in that

said telecommunication system is a mobile communication system in which said terminals comprise mobile stations, said telecommunication network comprises a mobile communication network and said centre of the telecommunication network comprises a mobile switching centre.

3. A telecommunication system as claimed in claim 2, **characterized** in that

the mobile switching centre comprises a subscriber database for maintaining subscriber data on a mobile subscriber when the mobile station is located within the area of the mobile switching centre, and

said subscriber data comprises information on the speech codecs supported by the subscriber's mobile station.

4. A telecommunication system as claimed in any one of claims 1 to 3, **characterized** in that

said handshaking is carried out as outband signalling.

5. A telecommunication system as claimed in claim 4, **characterized** in that

the mobile switching centres are arranged to carry out said handshaking in association with a routing information inquiry in response to the called subscriber being a mobile subscriber.

6. A telecommunication system as claimed in claim 5, **characterized**

terized in that

the mobile switching centre of the calling subscriber is arranged to send a routing information inquiry comprising information on the speech codecs supported by the mobile station,

the mobile switching centre of the called subscriber is arranged to select for the call connection a speech codec which the mobile stations of both the called and calling subscribers support, and

the mobile switching centre of the called subscriber is arranged to send information on said speech codec, selected for the call connection, in a reply message to the routing information inquiry.

7. A telecommunication system as claimed in claim 6, **characterized** in that

said routing information inquiry and reply message to the routing information inquiry are arranged to pass via the home database of the called subscriber.

8. A telecommunication system as claimed in claim 4, **characterized** in that

the mobile switching centres are arranged to carry out said handshaking in association with inter-MSC signalling, such as ISUP signalling.

9. A telecommunication system as claimed in claim 8, **characterized** in that

the mobile switching centre of the calling subscriber is arranged to send a message requesting connection set-up, such as an IAM message according to ISUP signalling, the message containing information on the speech codecs supported by the mobile station,

the mobile switching centre of the called subscriber is arranged to select for the call connection a speech codec which the mobile stations of both the called and calling subscribers support, and

the mobile switching centre of the called subscriber is arranged to send information on said codec, selected for the call connection, in a reply message to the connection set-up message, such as in an ANM message according to ISUP signalling.

10. A telecommunication system as claimed in any one of the preceding claims, **characterized** in that

when required, at least one of the mobile switching centres is arranged to notify the mobile station of the speech codec it has to use as the re-

sult of said handshaking.

11. A telecommunication system as claimed in claim 10, **characterized** in that

the mobile switching centre is arranged to notify the mobile station of the speech codec to be used if it is not the default speech codec of the mobile station.

12. A telecommunication system as claimed in any one of the preceding claims, **characterized** in that

a pulse code modulated (PCM) digital link exists between the mobile switching centres, and

the mobile switching centres are arranged to control the transcoder units at the ends of said link to adapt the encoded speech signal to one or more least significant bits of PCM samples without transcoding.

13. A telecommunication system as claimed in any one of claims 1 to 11, **characterized** in that

a packet-switched link exists between the mobile switching centres, such as a network based on the ATM or IP technology, and

the mobile switching centres are arranged to connect a call connection past the transcoder unit.

14. A centre in a digital telecommunication network, the centre being arranged to connect a transcoder located in a transcoder unit to a call connection when required, **characterized** in that

said centre is arranged to perform handshaking with the centre of a called terminal, said handshaking including notification of the speech codecs supported by the calling terminal, to choose the speech codec used by the terminals, and

said centre is arranged to connect a call connection past the transcoder unit or to control the transcoder unit to let the encoded speech through without speech encoding operations in such a way that speech encoding and decoding are only carried out in the terminal.

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PCT REQUEST

2980530PC/TA

Original (for SUBMISSION) - printed on 19.10.1999 12:50:04 PM

0 0-1	For receiving Office use only International Application No.	PCT/FI 9 9 / 0 0 8 6 8
0-2	International Filing Date	19 OCT 1999 (19. 10. 99)
0-3	Name of receiving Office and "PCT International Application"	The Finnish Patent Office PCT International Application

0-4 0-4-1	Form - PCT/RO/101 PCT Request Prepared using	PCT-EASY Version 2.84 (updated 01.07.1999)
0-5	Petition The undersigned requests that the present international application be processed according to the Patent Cooperation Treaty	
0-6	Receiving Office (specified by the applicant)	National Board of Patents and Registration (Finland) (RO/FI)
0-7	Applicant's or agent's file reference	2980530PC/TA
I	Title of invention	DIGITAL TELECOMMUNICATION SYSTEM
II II-1 II-2 II-4 II-5 II-6 II-7	Applicant This person is: Applicant for Name Address: State of nationality State of residence	 applicant only all designated States except US NOKIA NETWORKS OY Keilalahdentie 4 FIN-02150 Espoo Finland FI FI
III-1 III-1-1 III-1-2 III-1-4 III-1-5 III-1-6 III-1-7	Applicant and/or inventor This person is: Applicant for Name (LAST, First) Address: State of nationality State of residence	 applicant and inventor US only VERKAMA, Markku Hakamäki 2 A 12 FIN-02120 Espoo Finland FI FI

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IV-1	**Agent or common representative; or address for correspondence** The person identified below is hereby/has been appointed to act on behalf of the applicant(s) before the competent International Authorities as:	agent
IV-1-1	Name	KOLSTER OY AB
IV-1-2	Address:	Iso Roobertinkatu 23 P.O. Box 148 FIN-00121 Helsinki Finland
IV-1-3	Telephone No.	358 9 618 821
IV-1-4	Facsimile No.	358 9 602 244
IV-1-5	e-mail	kolster@kolster.fi
V	**Designation of States**	
V-1	Regional Patent (other kinds of protection or treatment, if any, are specified between parentheses after the designation(s) concerned)	AP: GH GM KE LS MW SD SL SZ UG ZW and any other State which is a Contracting State of the Harare Protocol and of the PCT EA: AM AZ BY KG KZ MD RU TJ TM and any other State which is a Contracting State of the Eurasian Patent Convention and of the PCT EP: AT BE CH&LI CY DE DK ES FI FR GB GR IE IT LU MC NL PT SE and any other State which is a Contracting State of the European Patent Convention and of the PCT OA: BF BJ CF CG CI CM GA GN GW ML MR NE SN TD TG and any other State which is a member State of OAPI and a Contracting State of the PCT
V-2	National Patent (other kinds of protection or treatment, if any, are specified between parentheses after the designation(s) concerned)	AE AL AM AT (patent and utility model) AU AZ BA BB BG BR BY CA CH&LI CN CR CU CZ (patent and utility model) DE (patent and utility model) DK (patent and utility model) DM EE (patent and utility model) ES FI (patent and utility model) GB GD GE GH GM HR HU ID IL IN IS JP KE KG KP KR KZ LC LK LR LS LT LU LV MD MG MK MN MW MX NO NZ PL PT RO RU SD SE SG SI SK (patent and utility model) SL TJ TM TR TT TZ UA UG US UZ VN YU ZA ZW
V-3	National Patent (States which have become party to the PCT after the issuance of this version of EASY)	MA Morocco

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V-5	**Precautionary Designation Statement** In addition to the designations made under items V-1, V-2 and V-3, the applicant also makes under Rule 4.9(b) all designations which would be permitted under the PCT except any designation(s) of the State(s) indicated under item V-6 below. The applicant declares that those additional designations are subject to confirmation and that any designation which is not confirmed before the expiration of 15 months from the priority date is to be regarded as withdrawn by the applicant at the expiration of that time limit.		
V-6	**Exclusion(s) from precautionary designations**	NONE	
VI-1	**Priority claim of earlier national application**		
VI-1-1	Filing date	21 October 1998 (21.10.1998)	
VI-1-2	Number	982283	
VI-1-3	Country	FI	
VI-2	**Priority document request** The receiving Office is requested to prepare and transmit to the International Bureau a certified copy of the earlier application(s) identified above as item(s):	VI-1	
VII-1	**International Searching Authority Chosen**	Swedish Patent Office (ISA/SE)	
VIII	**Check list**	number of sheets	electronic file(s) attached
VIII-1	Request	4	-
VIII-2	Description	13	-
VIII-3	Claims	3	-
VIII-4	Abstract	1	2980530p.txt
VIII-5	Drawings	2	-
VIII-7	TOTAL	23	
	Accompanying items	paper document(s) attached	electronic file(s) attached
VIII-8	Fee calculation sheet	✓	-
VIII-10	Copy of general power of attorney	✓	-
VIII-16	PCT-EASY diskette	-	diskette
VIII-17	Other (specified):	Copy of Official Action	-
VIII-18	**Figure of the drawings which should accompany the abstract**	5	
VIII-19	**Language of filing of the international application**	English	
IX-1	**Signature of applicant or agent**	Tapio Valkeiskangas	
IX-1-1	Name	KOLSTER OY AB	

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10-1	**Date of actual receipt of the purported international application**	19 OCT 1999	(19 -10- 1999)

PCT REQUEST

2980530PC/TA

Original (for SUBMISSION) - printed on 19.10.1999 12:50:04 PM

10-2 10-2-1 10-2-2	Drawings: Received Not received	
10-3	Corrected date of actual receipt due to later but timely received papers or drawings completing the purported international application	
10-4	Date of timely receipt of the required corrections under PCT Article 11(2)	
10-5	International Searching Authority	ISA/SE
10-6	Transmittal of search copy delayed until search fee is paid	X

FOR INTERNATIONAL BUREAU USE ONLY

11-1	Date of receipt of the record copy by the International Bureau	

CLAIMS

1. A digital telecommunication system wherein terminals and a telecommunication network comprise speech codecs, the speech codecs of the telecommunication network being disposed in a transcoder unit, from which a centre in the telecommunication network connects a transcoder for a speech connection, when required, **characterized** in that

the centre of the calling terminal is arranged to perform handshaking with the centre of the called terminal concerning the speech codec used by the terminals, and

the centres are arranged to establish call connections past the transcoder unit or to control the transcoder units to let the encoded speech through without speech encoding operations so that speech is encoded and decoded only in the terminals.

2. A telecommunication system as claimed in claim 1, **characterized** in that

said telecommunication system is a mobile communication system in which said terminals comprise mobile stations, said telecommunication network comprises a mobile communication network and said centre of the telecommunication network comprises a mobile switching centre.

3. A telecommunication system as claimed in claim 2, **characterized** in that

the mobile switching centre comprises a subscriber database for maintaining subscriber data on a mobile subscriber when the mobile station is located within the area of the mobile switching centre, and

said subscriber data comprises information on the speech codecs supported by the subscriber's mobile station.

4. A telecommunication system as claimed in any one of claims 1 to 3, **characterized** in that

said handshaking is carried out as outband signalling.

5. A telecommunication system as claimed in claim 4, **characterized** in that

the mobile switching centres are arranged to carry out said handshaking in association with a routing information inquiry in response to the called subscriber being a mobile subscriber.

6. A telecommunication system as claimed in claim 5, **characterized**

terized in that

the mobile switching centre of the calling subscriber is arranged to send a routing information inquiry comprising information on the speech codecs supported by the mobile station,

the mobile switching centre of the called subscriber is arranged to select for the call connection a speech codec which the mobile stations of both the called and calling subscribers support, and

the mobile switching centre of the called subscriber is arranged to send information on said speech codec, selected for the call connection, in a reply message to the routing information inquiry.

7. A telecommunication system as claimed in claim 6, **characterized** in that

said routing information inquiry and reply message to the routing information inquiry are arranged to pass via the home database of the called subscriber.

8. A telecommunication system as claimed in claim 4, **characterized** in that

the mobile switching centres are arranged to carry out said handshaking in association with inter-MSC signalling, such as ISUP signalling.

9. A telecommunication system as claimed in claim 8, **characterized** in that

the mobile switching centre of the calling subscriber is arranged to send a message requesting connection set-up, such as an IAM message according to ISUP signalling, the message containing information on the speech codecs supported by the mobile station,

the mobile switching centre of the called subscriber is arranged to select for the call connection a speech codec which the mobile stations of both the called and calling subscribers support, and

the mobile switching centre of the called subscriber is arranged to send information on said codec, selected for the call connection, in a reply message to the connection set-up message, such as in an ANM message according to ISUP signalling.

10. A telecommunication system as claimed in any one of the preceding claims, **characterized** in that

when required, at least one of the mobile switching centres is arranged to notify the mobile station of the speech codec it has to use as the

result of said handshaking.

11. A telecommunication system as claimed in claim 10, **characterized** in that

the mobile switching centre is arranged to notify the mobile station of the speech codec to be used if it is not the default speech codec of the mobile station.

12. A telecommunication system as claimed in any one of the preceding claims, **characterized** in that

a pulse code modulated (PCM) digital link exists between the mobile switching centres, and

the mobile switching centres are arranged to control the transcoder units at the ends of said link to adapt the encoded speech signal to one or more least significant bits of PCM samples without transcoding.

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a packet-switched link exists between the mobile switching centres, such as a network based on the ATM or IP technology, and

the mobile switching centres are arranged to connect a call connection past the transcoder unit.

14. A centre in a digital telecommunication network, the centre being arranged to connect a transcoder located in a transcoder unit to a call connection when required, **characterized** in that

said centre is arranged to perform handshaking with the centre of a called terminal concerning the speech codec used by the terminals, and

said centre is arranged to connect a call connection past the transcoder unit or to control the transcoder unit to let the encoded speech through without speech encoding operations in such a way that speech encoding and decoding are only carried out in the terminal.